Claims

We Claim:

1. A method of reducing the toxicity of at least one onium compound in an aqueous solution comprising

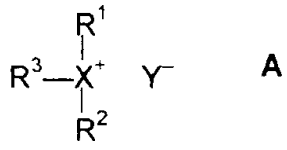
adding to the aqueous solution an amount of an additive sufficient to reduce the toxicity of the onium compound, where the treated onium compound partitions into a non-aqueous phase; and

removing the non-aqueous phase from the aqueous solution,

where the additive is a compound selected from the group consisting of carboxylic acids, sulfonic acids, organophosphonic acids, phenolic compounds, ether sulfates, phosphoric acid esters, sulfonated fatty acids, sulfated fatty acids, oligocarboxylic acids, and mixtures thereof, and alkali metal salts of these compounds and amine salts of these compounds.

2. The method of claim 1 where the additive is selected from the group consisting of carboxylic acids, sulfonic acids, and mixtures thereof, alkali metal salts of these compounds and amine salts of these compounds.

3. The method of claim 1 wherein the onium compound has a structure of the following formula having a cation and an anion Y^-:



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wherein R^1 and R^2 each are independently selected from normal or branched alkyls containing a chain of at least 4 carbon atoms, with or without one or more substituents, or one or more heteroatoms;

R^3 is an organic moiety containing a chain of at least 4 carbon atoms, with or without one or more substituents, or one or more heteroatoms;

X is S, N—R^4 or P—R^4;

R^4, if present, is selected from H or an alkyl, aryl, alkylaryl, alkenylaryl or alkenyl group, preferably those having from about 1 to about 20 carbon atoms, with or without one or more substituents, or one or more heteroatoms; and

Y^- is selected from the group consisting of hydroxide ion (OH^-), halide ions, carboxylate ions, sulfate ion, organic sulfonate ions, and mixtures thereof.

4. The method of claim 1 wherein the effective amount of the additive ranges from about 10:1 to about 1:10 in weight ratio with the onium compound.

5. The method of claim 1 further comprising adding a non-aqueous phase to the aqueous solution prior to removing the non-aqueous phase from the aqueous solution.

6. The method of claim 1 where the onium compound and the additive are added to the aqueous solution together.

7. A method of reducing the toxicity of at least one onium compound in an aqueous solution comprising

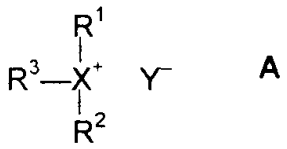
adding the aqueous solution an amount of an additive sufficient to reduce the toxicity of the onium compound, where the treated onium compound partitions into a non-aqueous phase;

adding a non-aqueous phase to the aqueous solution before, during or after the additive is added to the aqueous solution; and

removing the non-aqueous phase from the aqueous solution,

where the additive is a compound selected from the group consisting of carboxylic acids, sulfonic acids, organophosphonic acids, phenolic compounds, ether sulfates, phosphoric acid esters, sulfonated fatty acids, sulfated fatty acids, oligocarboxylic acids, and mixtures thereof, and alkali metal salts of these compounds and amine salts of these compounds; and

where the onium compound has a structure of the following formula having a cation and an anion Y^-:



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wherein R^1 and R^2 each are independently selected from normal or branched alkyls containing a chain of at least 4 carbon atoms, with or without one or more substituents, or one or more heteroatoms;

R^3 is an organic moiety containing a chain of at least 4 carbon atoms, with or without one or more substituents, or one or more heteroatoms;

X is S, N—R^4 or P—R^4;

R^4, if present, is selected from H or an alkyl, aryl, alkylaryl, alkenylaryl or alkenyl group, preferably those having from about 1 to about 20 carbon atoms, with or without one or more substituents, or one or more heteroatoms; and

Y^- is selected from the group consisting of hydroxide ion (OH^-), halide ions, carboxylate ions, sulfate ion, organic sulfonate ions, and mixtures thereof.

8. The method of claim 7 wherein the effective amount of the additive ranges from about 10:1 to about 1:10 in weight ratio with the onium compound.

9. The method of claim 7 wherein the additive is selected from the group consisting of carboxylic acids, sulfonic acids, and mixtures thereof, alkali metal salts of these compounds and amine salts of these compounds.

10. The method of claim 7 where the onium compound and the additive are added to the aqueous solution together.

11. An aqueous solution comprising:

water;

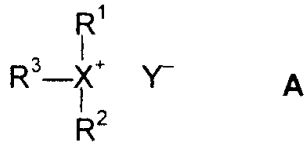
at least one onium compound; and

at least one additive selected from the group consisting of carboxylic acids, sulfonic acids, organophosphonic acids, phenolic compounds, ether sulfates, phosphoric acid esters, sulfonated fatty acids, sulfated fatty acids, oligocarboxylic acids, and mixtures thereof, and alkali metal salts of these compounds and amine salts of these compounds.

12. The aqueous solution of claim 11 where the treated onium compound partitions into a non-aqueous phase, and where the amount of the additive is sufficient to reduce the toxicity of the aqueous solution as compared with an identical aqueous solution having an absence of the additive.

13. The aqueous solution of claim 11 where the additive is selected from the group consisting of carboxylic acids, sulfonic acids, and mixtures thereof, alkali metal salts of these compounds and amine salts of these compounds.

14. The aqueous solution of claim 11 wherein the onium compound has a structure of the following formula having a cation and an anion Y^-:



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wherein R^1 and R^2 each are independently selected from normal or branched alkyls containing a chain of at least 4 carbon atoms, with or without one or more substituents, or one or more heteroatoms;

R^3 is an organic moiety containing a chain of at least 4 carbon atoms, with or without one or more substituents, or one or more heteroatoms;

X is S, N—R^4 or P—R^4;

R^4, if present, is selected from H or an alkyl, aryl, alkylaryl, alkenylaryl or alkenyl group, preferably those having from about 1 to about 20 carbon atoms, with or without one or more substituents, or one or more heteroatoms; and

Y^- is selected from the group consisting of hydroxide ion (OH^-), halide ions, carboxylate ions, sulfate ion, organic sulfonate ions, and mixtures thereof.

15. The aqueous solution of claim 11 wherein the effective amount of the additive ranges from about 10:1 to about 1:10 in weight ratio with the onium compound.

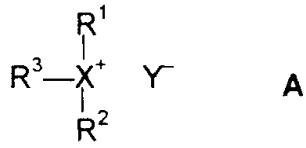
16. The aqueous solution of claim 11 further comprises a separately added non-aqueous phase.

17. An aqueous solution comprising:

water;

a non-aqueous phase;

at least one onium compound having a structure of the following formula having a cation and an anion Y^-:



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wherein R^1 and R^2 each are independently selected from normal or branched alkyls containing a chain of at least 4 carbon atoms, with or without one or more substituents, or one or more heteroatoms;

R^3 is an organic moiety containing a chain of at least 4 carbon atoms, with or without one or more substituents, or one or more heteroatoms;

X is S, N—R^4 or P—R^4;

R^4, if present, is selected from H or an alkyl, aryl, alkylaryl, alkenylaryl or alkenyl group, preferably those having from about 1 to about 20 carbon atoms, with or without one or more substituents, or one or more heteroatoms; and

Y^- is selected from the group consisting of hydroxide ion (OH^-), halide ions, carboxylate ions, sulfate ion, organic sulfonate ions, and mixtures thereof; and

at least one additive selected from the group consisting of carboxylic acids, sulfonic acids, organophosphonic acids, phenolic compounds, ether sulfates, phosphoric acid esters, sulfonated fatty acids, sulfated fatty acids, oligocarboxylic acids, and mixtures thereof, and alkali metal salts of these compounds and amine salts of these compounds,

where the treated onium compound partitions into the non-aqueous phase, and

where the amount of the additive is sufficient to reduce the toxicity of the aqueous solution as compared with an identical aqueous solution having an absence of the additive.

18. The aqueous solution of claim 17 wherein the effective amount of the additive ranges from about 10:1 to about 1:10 in weight ratio with the onium compound.

19. The aqueous solution of claim 17 wherein the additive is selected from the group consisting of carboxylic acids, sulfonic acids, and mixtures thereof, alkali metal salts of these compounds and amine salts of these compounds.